Remarks/Arguments:

In response to the Office Action dated January 29, 2010, please consider the following remarks and arguments.

Examiner Interview

As a preliminary matter, Applicants thank Patent Examiner Jie Yang and Supervisory Patent Examiner Roy King for the time and courtesy they extended to Applicants' representative on July 7, 2010. During the Interview, proposed amendments to claim 5 and proposed new claims 30-33 were discussed. Additionally, the sole prior art reference (Hino et al.) was addressed during the Interview, including a discussion of the disclosure of Hino et al. and the distinctions between the claimed method and the method disclosed by Hino et al.

The Examiners suggested the submission of amendments and new claims, like those proposed, in response to the Office Action. That way, the Examiners can give specific consideration to the individual steps recited in the amended method claims.

Pending Claims

Claims 5-17 and 22-29 are currently pending. Independent claims 5, 8, 12, and 16 have been amended, and new claims 30-33 have been added.

Claim Amendments

The independent claims have been amended to clarify that the claimed steel product manufacturing method includes, among other steps, a series of steps for selecting the heat treatment time for the steel product. These amendments are fully supported in the application as originally filed; for example, see Figures 11-13, the corresponding descriptions of Figures 11-13 in the specification, and other descriptions in the original specification including those mentioned below.

In claim 5 for example, the steps for selecting the heat treatment time are amended as follows:

1) Step (d) is amended to clarify that the selection of the number of times of passage is made based on heat treatment times when the number of times of passage is one (as determined by step (b)) and when the number of times of passage is not less than two (as determined by step (c)).
2) Additionally, steps (b) and (c) are both amended to clarify that the determinations of transfer speed and the amount of electric power in those steps are based on the dimensions and the necessary temperature rise of the steel product determined by step (a).
3) Finally, step (e) is amended to clarify that the determination of transfer speed and the amount of electric power for each passage is based on the number of times of passage selected in step (d).

Accordingly, each of the pending claims has been clarified to emphasize that they recite a series of steps performed as part of the steel product manufacturing method.

New Claims

New claims 30-33 have been added to recite preferred aspects of the invention. Support for the subject matter recited in claims 30-33 can be found in Figures 11-13, in the disclosure corresponding to Figures 11-13, and elsewhere throughout the application as originally filed.

New claim 30 recites that the step of passing the steel product at least once through the plurality of induction heating apparatuses comprises passing the steel product continuously through the plurality of induction heating apparatuses within each pass without stopping the steel product. The passing step recited in claim 30 is neither disclosed nor suggested in the cited Hino et al. reference. Instead, Hino et al. actually teaches away from this subject matter of new claim 30. Specifically, Hino et al. teaches a discontinuous heat treatment method wherein heating the steel plate in each heating cycle begins after the surface temperature of the steel plate in the preceding heating cycle becomes at or lower than the mean temperature in the thickness direction of the steel plate. Paragraph [0008].

New claim 31 recites the step of determining a possible number of times of passage for the steel product based on the dimensions and the necessary temperature rise of the steel product determined in step (a). This step therefore identifies, for each steel product, how many passages can possibly be used to heat treat that steel product. For example, a particular steel product might be suitably treated using one passage, three passages, or five passages. As disclosed on page 31 of the application, for example, "Step 1" according to one embodiment includes determining the number of times of passage (for example, one, three, five) for possible heating of a steel product as candidates for the heat treatment process. The step recited in claim 31 is neither disclosed nor suggested by Hino et al.

New claim 32 recites the steps of determining a target treatment time and selecting the number of times of passage in which the heat treatment time becomes the shortest *or* the number of times of passage in which electric power for heating becomes minimum based on the target treatment time. According to this aspect of the invention, these steps permit the selection of the shortest heat treatment time (e.g., to reduce or eliminate waiting when there is a subsequent steel product that is ready to be treated) *or* the heat treatment time when the electric power for heating becomes minimum (e.g., in a circumstance when there is sufficient time to prioritize for power savings). The steps recited in claim 32 are neither disclosed nor suggested by Hino et al.

New claim 33, like new claim 32, recites the target treatment time determining step and the number of times of passage selection step. The combination of steps recited in claim 33 is neither disclosed nor suggested by Hino et al.

The Claimed Invention

Generally, this invention provides a steel product manufacturing method that includes steps for heat treating a steel product which has been subjected to quenching or accelerated cooling on a hot rolling line after hot rolling. Heat treating is performed by passing the steel product at least once through a plurality of induction heat apparatuses installed on the hot rolling line, and the heat treatment conditions are determined by conducting a series of defined steps.

For purposes of illustration, Figure 11 is a general flowchart of operation according to one embodiment of the invention. As described beginning at page 31 of the specification, that flowchart illustrates four steps summarized here:

Step 1: The number of times of passage (for example, one, three, five) for possible heating is determined as a candidate based on the dimensions and the temperature rise of a particular steel product.

Step 2: The transfer speed and the electric power for heating are calculated based on the number of times of passages determined in Step 1, and treatment time is calculated.

Step 3: The target treatment time available to prevent or reduce the waiting of a succeeding steel product is calculated. This step includes judging whether the treatment time should have priority, thus providing a choice between

(a) a shorter treatment time or

(b) a treatment time in which the electric power for heating becomes minimum for example.

Step 4: Transfer speed and electric power are determined corresponding to the number of times of passage selected in Step 3.

Referring specifically to the embodiment of the invention illustrated in Figure 13, the flow diagram illustrates the choice in which treatment time may or may not have priority. If treatment time does have priority (the "YES" option in Figure 13), the number of times of passage to make the treatment time the shortest can be selected. If treatment time does not have priority (the "NO" option in Figure 13), then the number of times of passage for minimum power consumption can be selected. More specifically, after the heat treatment patterns are first determined for several candidate numbers of times of passage, e.g., by steps (b) and (c) of claim 5, the optimum heat treatment parameter such as time, electric power, etc. is selected as described at page 31, lines 12-15 of this application.

For example, as is specifically recited in amended claims 5 and 16, the heat treatment time is selected to be the shortest time and is determined using the following series of steps:

a) determining the dimensions of the steel product and a necessary temperature rise of the steel product to be subjected to the heat treating,

b) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is one based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

c) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is not less than two based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

d) selecting a number of times of passage in which the heat treatment time *becomes the shortest* based on heat treatment times when the number of times of passage is one in step (b) and when the number of times of passage is not less than two in step (c), and

e) determining the transfer speed and the amount of electric power for the induction heating apparatuses for each passage of the number of times of passage selected in step (d).

These steps are beneficial in that they can prevent a succeeding steel product from waiting on the hot rolling line, or reduce any waiting time, as described on page 7, lines 18-20 of this application. In claims 5 and 16, heat treatment time is therefore selected to be the shortest time.

In contrast to the language of claims 5 and 16, in amended claims 8 and 12 the heat treatment time (which may or may not be the shortest time) is selected to fall within a target treatment time and is determined using the following series of steps:

(a) determining the dimensions of the steel product and a necessary temperature rise of the steel product to be subjected to the heat treating,

(b) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is one based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

(c) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is not less than two based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

(d) selecting a number of times of passage in which the heat treatment time *falls within the target treatment time* based on the heat treatment times when the number of times of passage is one in step (b) and when the number of times of passage is not less than two in step (c), and

(e) determining the transfer speed and the amount of electric power for the induction heating apparatuses for each passage of the number of times of passage selected in step (d).

These steps are beneficial in that they can minimize the consumption of electric power as described on page 35, lines 3-9 of this application. In claims 8 and 12, heat treatment time is therefore selected to be within a target treatment time in order to, for example, conserve energy.

In new claim 33, heat treatment time is selected to be a time that becomes the shortest *or* falls within a target treatment time, wherein the heat treatment time is determined by the following steps:

(a) determining the dimensions of the steel product and a necessary temperature rise of the steel product to be subjected to the heat treating,

(b) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is one based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

(c) determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is not less than two based on the dimensions and the necessary temperature rise of the steel product determined in step (a),

(d) determining a target treatment time based on the time when cooling of the steel product is completed or when it arrives at the induction heating apparatuses and the time when cooling of a succeeding steel product will be completed,

(e) selecting the number of times of passage in which the heat treatment time *becomes the shortest* or the number of times of passage in which *electric power for heating becomes minimum* based on the target treatment time determined in step (d), and

(f) determining the transfer speed and the amount of electric power for the induction heating apparatuses for each passage of the number of times of passage selected in step (e).

Accordingly, a target treatment time is determined in step (d) based in part on the time when cooling of a succeeding steel product will be completed. Then, in step (e) based on the target treatment time determined in step (d), the number of times of passage is selected in which the heat treatment time *becomes the shortest* or the number of times of passage in which *electric power for heating becomes minimum*.

These steps are beneficial in that they select heat treatment time based on priority as between options of (1) the shortest heat treatment time or (2) the heat treatment time in which electric power for heating becomes minimum, depending on the target treatment time determined in step (d), as described beginning on page 34, line 24 of this application.

Claim Rejections

Claims 5-17 and 22-29 stand rejected as being obvious in view of Hino et al. (EP 1359230). It is respectfully submitted that this rejection should be withdrawn in view of the amendments to the claims and the following remarks.

As discussed during the Interview, Hino et al. disclosed a discontinuous heat treatment method wherein heating the steel plate in each heating cycle in the step of tempering begins after the surface temperature of the steel plate in the preceding heating cycle becomes at or lower than the mean temperature in the thickness direction of the steel plate. Paragraph [0008].

It is respectfully submitted that the Hino et al. reference fails to establish a *prima facie* basis for obviousness of the pending claims and should be withdrawn as a reference. The Office Action fails to indicate any disclosure or suggestion of the series of steps (a) through (d) recited in claim 5, for example (note that claim 5, as amended herein, now includes steps (a) through (e)). As a specific example, Hino et al. failed to disclose or suggest steps (b) and (c) of claim 5; namely, the steps of determining the transfer speed and the amount of electric power for the induction heating apparatuses (1) when the number of times of passage is one and (2) when the number of times of passage is not less than two. Additionally, step (d) of claim 5 is neither disclosed nor suggested; namely, the step of selecting a number of times of passage, from among the number of passages of steps (b) and (c), in which the heat treatment time becomes the shortest.

The Office Action fails to identify any suggestion in Hino et al. of at least these steps of the series of steps recited in amended claim 5 for determining heat treatment time. Claim 16 also recites these steps. Accordingly, the Office Action fails to establish *prima facie* obviousness for at least claims 5-7, 16-17, 22, 23, 28, and 29.

Similarly, the Office Action fails to indicate any disclosure or suggestion of the series of steps (a) through (d) recited in claim 8, for example (note that claim 8, as amended herein, now includes steps (a) through (e)). As a specific example, Hino et al. failed to disclose or suggest steps (b) and (c) of claim 8; namely, the steps of determining the transfer speed and the amount of electric power for the induction heating apparatuses (1) when the number of times of passage is one and (2) when the number of times of passage is not less than two. Additionally, step (d) of claim 8 is neither disclosed nor suggested; namely, the step of selecting a number of times of passage, from the number of passages of steps (b) and (c), in which the heat treatment time falls within the target treatment time.

Therefore, the Office Action fails to identify any suggestion in Hino et al. of at least these steps of the series of steps recited in amended claim 8 for determining heat treatment time. Claim 12 also recites these steps. Accordingly, the Office Action fails to establish *prima facie* obviousness for at least claims 8-15 and 24-27 as well.

It is noted that the Office Action relies upon allegations of "result-effective variables" with citation to MPEP §2144.05 II as the basis of the obviousness rejection. However, it is respectfully submitted that such a basis for rejection does not apply to the pending claims because they do not recite values of any result-effective variables.

Result-effective variables relate to optimization of ranges, which is the title of the relevant MPEP section. Each of the cases cited in MPEP 2144.05 IIB relates to the patentability of claims that recite optimum or workable ranges of variables that might be characterized as routine experimentation. For example, *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) considered a claim that recited a tank volume to contractor area of 0.12 gal./sq. ft., and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) considered a claim that recited an N v value not in excess of about 2.35.

The pending claims do not, however, recite optimum or workable ranges. Instead, they recite a series of steps for manufacturing a steel product.

For example, regarding step (b) of claims 5, 8, 12, and 16, the Office Action states on Page 4 that:

> The transfer speed (step b) of the steel product [sic] is a result-effective variable in term [sic] of uniform heating, which is evidenced by EP'230. It would have been obvious to one skilled in the art to have optimized travel speed, for example, the speed is changed every time of passing through the induction heating apparatus in order to obtain desired uniform heating. See MPEP 2144.05 II.

However, the Office Action fails to address the claimed method steps of:

> Step (b): determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is one based on the dimensions and the necessary temperature rise of the steel product determined in step (a); and
>
> Step (c): determining the transfer speed and the amount of electric power for the induction heating apparatuses when the number of times of passage is not less than two based on the dimensions and the necessary temperature rise of the steel product determined in step (a).

The allegation that transfer speed is a result-effective variable does not explain how the Hino et al. reference might disclose or suggest these method steps (b) and (c) recited in claim 5. In fact, the Hino et al. reference does not disclose or suggest these steps.

Similarly, regarding step (d) of claims 5, 8, 12, and 16, the Office Action states on Page 4 that:

> The number of times of passage through the induction heating apparatus (step d) is also a result-effective variable in term [sic] of uniform heating during the heating time, which [sic] evidenced by EP'230. ... It would have been obvious to one skilled in the art to have optimized number of times of passage through the induction heating apparatus such that surface temperature and thickness-wise center temperature of the steel product fall in a predetermined temperature range (as claimed in the instant claims 5, 8), the predetermined upper limit temperature (as claimed in the instant claims 12 and 16), in the shortest time as claimed in the instant claims. See MPEP 2144.05 II.

However, in connection with claim 5 for example, the Office Action fails to address the claimed method step of

> Step (d): selecting a number of times of passage in which the heat treatment time becomes the shortest based on heat treatment times when the number of times of passage is one in step (b) and when the number of times of passage is not less than two in step (c).

The allegation that the number of times of passage is a result-effective variable does not explain how the Hino et al. reference might disclose or suggest this method step (d) recited in claim 5. In fact, the Hino et al. reference does not disclose or suggest this step.

For these reasons, none of the pending claims recites a value of a result-effective variable, and the Office Action fails to establish how the series of steps recited in the claims is rendered obvious by the Hino et al. reference. For this additional reason, the Office Action fails to establish *prima facie* obviousness.

Finally, in several locations, the Office Action cites to the same paragraphs of the Hino et al. reference in support of the obviousness rejection. Specifically, the Office Action includes five statements of the following citation, and it is also cited in the Examiner's Interview Summary:

> EP'230 teaches controlling the travel speed according [sic] dimension of object, induction power, the number of heating cycles and target heating temperature (Table 1, and Page 3, paragraph [0010] to page 4, paragraph [0023] of EP'230).

It is respectfully submitted, however, that the pending claims do not recite a step of "controlling travel speed according to the dimension of the object, induction power, the number of heating cycles and target heating temperature." Additionally, Hino et al. (in the cited paragraphs and elsewhere) failed to disclose or suggest the series of steps of the methods recited in the pending claims.

Declarations

Although *prima facie* obviousness has not been established in the Office Action for the reasons set forth above, and although the burden has not properly shifted to Applicants to come forward with arguments and/or evidence to rebut a *prima facie* case in connection with the amended claims, it is noted that evidence of non-obviousness is of record in the Declaration of Yoshitsugu Iijima, submitted on November 13, 2009, and the Declaration of Yoshitsugu Iijima, submitted on August 28, 2009. Those Declarations must be considered in any prospective determination of obviousness. MPEP 2145 (citing *In re Beattie*, 974 F.2d 1309, 1313, 24 USPQ2d 1040, 1042-43 (Fed. Cir. 1992) (Office personnel should consider declarations from those skilled in the art praising the claimed invention and opining that the art teaches away from the invention.)).

Conclusion

For the foregoing reasons, and in view of the clarifying amendments in the claims, it is respectfully submitted that this application is in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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